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Agricultural Research Institute, Pusa

Agricultural Implements and Machinery at Pusa
Part I

Cultivation Implements and Machinery

BY

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AGRICULTURAL IMPLEMENTS AND MACHINERY AT PUSA, PART I.

CULTIVATION IMPLEMENTS AND MACHINERY.

(Received for publication on 26th November 1948.)

The question of the introduction of modern types of agricultural implements and machinery is a very important one for India. The peculiar economic difficulties of the Indian agriculturist are very imperfectly understood by the large implement makers abroad. The huge size of the continent of India with its varied agricultural conditions is very seldom visualized. It is obvious that while a small ryot or cultivator with one or two acres of poor land is not in a position to adopt any expensive implement, yet there are many tracts where money is available and where there is a demand for implements of better type than those available locally.

As a contribution to the question of improved agricultural machinery for India, a detailed description is given of such implements and machinery as have passed through the acid test of practical work extending over a number of years at Pusa. No claim is made that the trials exhaust the list of implements on the market or that the implements described are suitable for all conditions. It was thought that data obtained through practical experience might be of considerable use to those interested in the above question.

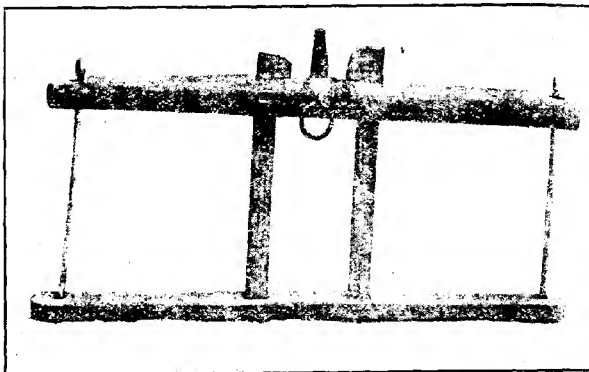
The conditions at Pusa are somewhat specialized. The majority of the land is of a light type of alluvium containing a large percentage of calcium. It is friable and easily worked. The most important crops are maize, oats and pulses. The area of the Pusa arable land is about 700 acres and the fields generally are large and level. There is only a small area of irrigated land where the cultivation is complicated by the presence of irrigation bunds.

The subject is divided into four heads as follows : --

- I. Cultivation Implements and Machinery.
- II. Harvesting and Threshing Implements and Machinery.
- III. Special and Miscellaneous Implements and Machinery.
- IV. Power Implements and Machinery.

BULLOCK POWER IMPLEMENTS AND MACHINERY.

These implements are drawn by a pair of bullocks with the simple neck yoke of which a photograph is given in Text-fig. 1. This type of yoke is used for all work with the exception of levelling and intercultivation ; in these cases it is made longer as required.



Text-fig. 1. Bullock Yoke

Generally speaking, it is not economical to have an implement drawn by more than one pair of bullocks. In special cases one pair of bullocks is used in front of another pair, but this involves considerable delay in turning at the headlands. Four bullocks abreast hitched to one neck yoke are never used at Pusa.

(a) Ploughs.

The modern plough is entirely a new implement to the Indian cultivator as the so-called "desi" plough is merely a one-toothed cultivator and breaks up the soil without inverting it. The "desi" plough has a pole and the land is generally worked in a circle with the bullocks turning to the left. The introduction of the modern plough involves some modifications of the ryot's usual customs. The following is a list of some of ploughs tested :—

Arlington Plough (American),

Cupido Plough (Belgian).

Diamond Plough (Cockshutt Plough Company of Brantford, Canada),

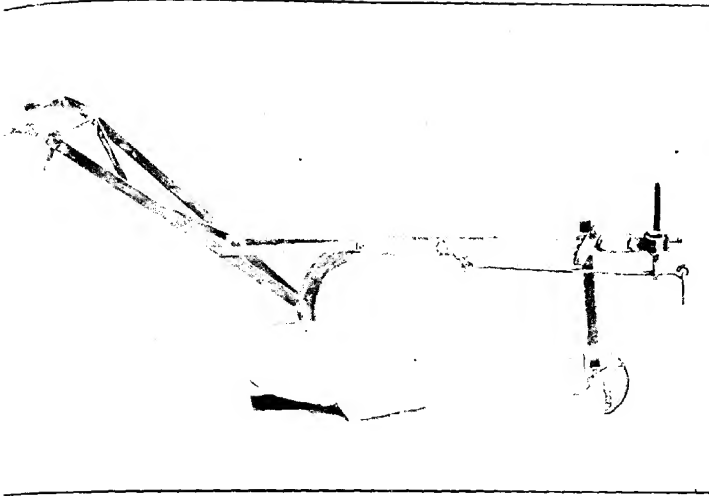


Fig. 1. Victory Plough (Furrow side).

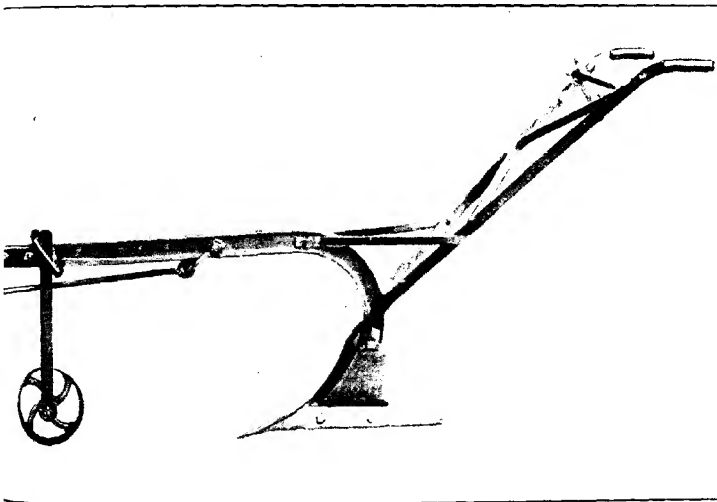


Fig. 2. Victory Plough (Land side).

PLATE II.



Defiance Disc Plough (Ransomes, Sims and Jefferies, England),
 Germinette Plough (French make),
 Gurgaon Plough (The Empire Engineering Company, Cawnpore),
 Hindustan Plough (B. F. Avery & Sons, Louisville),
 Jat Plough (Ransomes).
 Meston Plough (Ransomes).
 Monsoon Plough (Ransomes).
 Mysore Plough (Ransomes),
 Pioneer Gripping Plough (Belgian),
 Punjab Plough (Ransomes),
 Rajah Plough (American; Oliver Plow & Co.),
 Sabul Plough (Ransomes),
 Victory Plough (Ransomes),
 Wiard Plough (Kulkarni & Co., Dharwar, Bombay).

Out of the above lot, the Victory, the Punjab and the Rajah ploughs are in general use on the farm and have been found thoroughly efficient and durable. They are recommended for general purpose ploughs and are described below in more detail.

RANSOMES' ALL-STEEL VICTORY PLOUGH.

(Plates I and II.)

This is a simple light plough with a light draught. The plough body is built on a pressed steel bottom which firmly holds together the breast, share and land-side and is rigidly fixed to the beam. The plough is provided with two handles made of steel, a knife coulter and a head-wheel. The share is of solid wrought steel specially hardened and tempered. It will plough a furrow 3" to 6" deep and 6" to 10" wide. The average weight is 85 lb. and an ordinary pair of bullocks will pull it easily. From a half to one acre can be ploughed in a day depending of course on the efficiency of bullocks and ploughman. The Victory is specially suitable for ploughing in green manure, as the breast has a good curve and inverts the soil better than the Punjab or Rajah plough. Only a small single ended spanner is needed to make all adjustments. Price, Rs. 47-0-0; extra share, Rs. 4-4-0; obtainable from Messrs. Jessop & Co., Calcutta.

RANSOMES' PUNJAB PLOUGH.

(Plate III, fig. 1.)

This is a light plough fitted with a wooden beam and two wooden handles. The set of the beam is easily regulated sideways at its handle

end and at the beam head there is a clevis and hake which provides considerable lateral and vertical adjustment for draught. The share has a separate point easily renewable and the breast is in two pieces, (mould board and cutter). The cutter which is more liable to wear is easily replaceable at a low price. It will plough 3" to 6" deep and 6" to 8" wide. The weight is 64 lb. and two good bullocks will pull it easily. Price complete with head-wheel is Rs. 27-0-0 (iron work only) : can be had from Messrs. Jessop & Co., Calcutta.

THE RAJAH PLOUGH.

(Plate III, fig. 2.)

This plough is also like the Punjab and is a light furrow turning plough with wooden beam and a couple of wooden handles. It is strongly made and is capable of hard work. Depth of furrow is $4\frac{1}{2}$ " to 6" and width 9". The beam is set high in the throat so as to provide ample clearance. The mould board is one piece and is strongly made. Draught is suitable for one pair of bullocks ; price with head-wheel, Rs. 37-8-0 ; sold by Messrs. Volkart Bros., Bombay and Lyallpur.

(b) Harrows.

These are used for the preparation of the seed bed, for covering the seed and also to break the surface soil skin or *papri* which forms when there has been rain while the young crop is growing. At Pusa the common implements used in this connection are the Spring Tooth Harrow, the Flexible Chain Harrow and the Plank (Sohaga, Henga). The following types of harrows have been tried for a number of years.

Spring tooth harrow,
Disc harrows (plane and cutway),
Zig-zag harrow,
Parneter's single tyne harrow,
Norwegian harrow,
Brantford weeder,
Lever harrow,
Local made gallion and drag harrows.

Out of these the spring tooth harrow and flexible chain harrow and lever harrows are thoroughly adopted for all kinds of work.

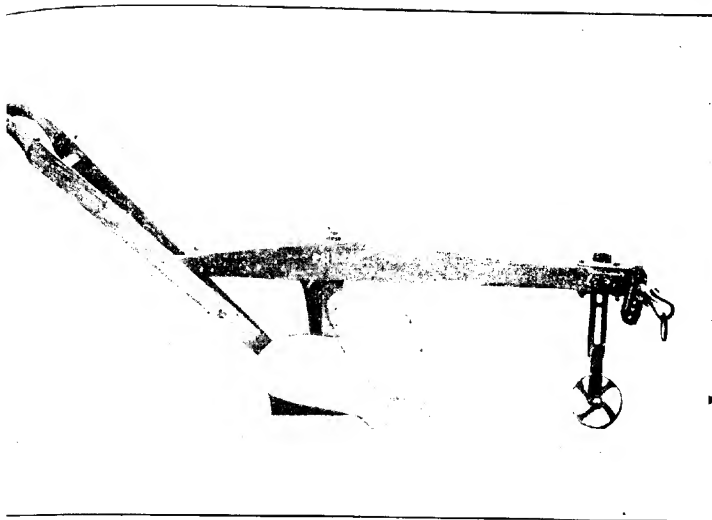


Fig. 1. The Punjab Plough.

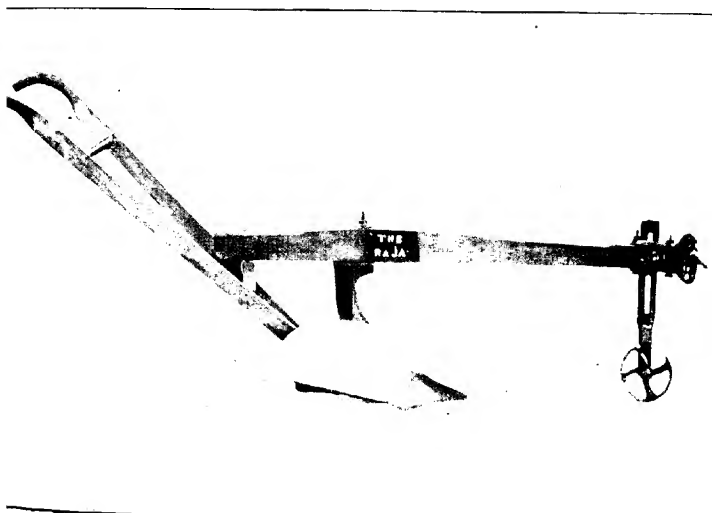


Fig. 2. The Rajah Plough.

PLATE IV.

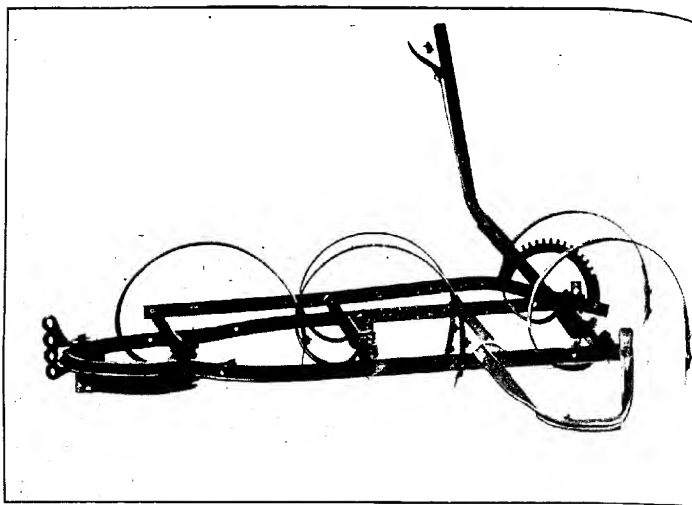


Fig. 1. Spring Tooth Harrow.

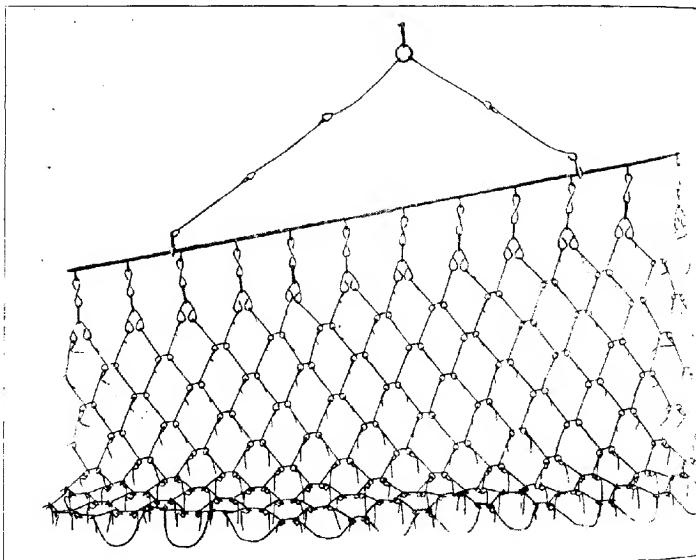


Fig. 2. Chain Harrow.

SPRING TOOTH HARROWS.

(Plate IV, fig. 1.)

Fig. 1 on Plate IV represents the two size of spring tooth harrows—7-tined and 5-tined. Both are most durable and strongly built. The tines which are all steel are adjustable for depth and pitch by means of a hand lever. These are provided with reversible and renewable points which can be adjusted to work for 1" to 4" depth. The 7-tined one is heavier than the 5-tined and will do 3 to 4 acres in a day with a pair of bullocks. The 5-tined one will do 2 to 3 acres. They do not require guiding by hand, the driver simply walks behind or alongside to drive the bullocks. Those with channel steel frames by Messrs. John Wallace & Sons, Glasgow, are strong and durable. Price: 7-tined, Rs. 59; 5 tined, Rs. 52; sold by Messrs. Volkart Bros., Lyallpur and Bombay.

CHAIN HARROW.

(Plate IV, fig. 2.)

The flexible chain harrow is a useful implement for collecting weeds and stubble especially in a double cropping system where one crop immediately follows the other, the weeds have to be removed before the second crop is sown. It shakes weeds out of the earth and collects them on the surface. It is also used for making a fine surface tilth and for covering seed after drilling. Where moisture is sufficient, one run after the drill will be enough and no planking is needed. It is useful for breaking *papri* after a shower of rain and before the germination of seeds and also for working over grass lands. It can be drawn over 10 to 12 acres of land in a day by a pair of bullocks. Messrs. P. J. Parmeter & Sons' (Tisbury Wilts, England) make, shown in Plate IV is light and durable. Price, Rs. 55; sold by Messrs. Volkart Bros., Lyallpur and Bombay.

SPIKE HARROWS.

(Plate V, fig. 1.)

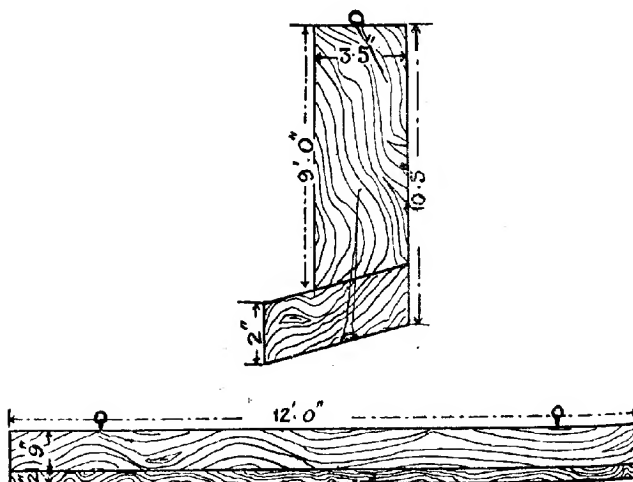
Various types are available. These are generally made in two shapes, triangular and rectangular. The single section Lever Harrow is the best type as the set of the spikes can be regulated by means of a hand lever to suit a variety of work. Its action is to comb out weeds from the lower depths. It is used in young crops for breaking the *papri* and to form a mulch. When used on young wheat and other *rabi* cereals it produces an excellent effect and conserves moisture. It is also useful

on grass lands. It can do 3 to 4 acres with a pair of bullocks. Price Rs. 40 ; sold by Messrs. Volkart Bros., Lyallpur and Bombay.

PLANK OR " HENGA."

(Text-fig. 2.)

This is an important home made implement. In India different types are used in different parts of the country. The one at present used on the Pusa Farm (Text-fig. 2) has been introduced by the writers and has been found most efficient. It is made of a piece of wooden plank measuring 12 ft. long, 9" and 8½" broad at the bottom and top, respectively, by 3" thick. To the back of this, another piece of plank 12 ft. × 6" × 2" is nailed, projecting 2" towards the bottom and side and making an angle of 105°. It has two iron hooks or eye bolts in front near both ends for attaching yoke chain or ropes. It is drawn by two pairs of bullocks. This implement pulverizes the soil by its dragging action and breaks clods and makes fine tilth. It is also used for covering seed.



TYPE OF HENGA AT THE PUSA FARM.

TEXT-FIG. 2.

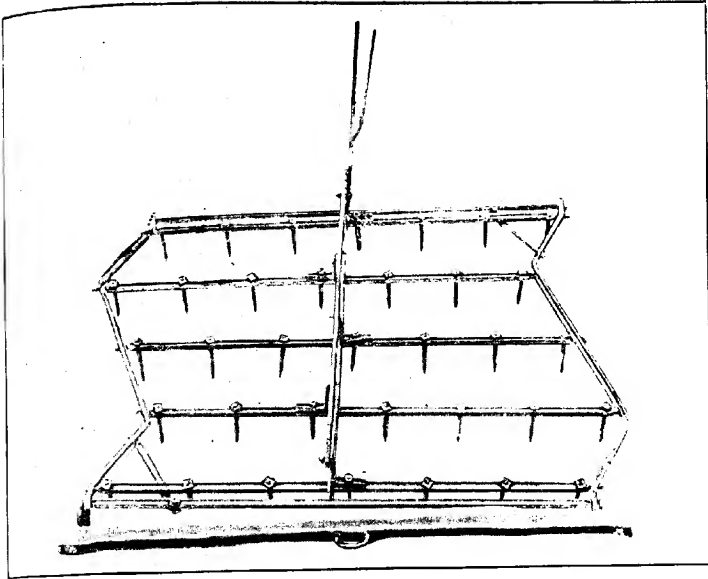


Fig. 1. Lever Harrow.

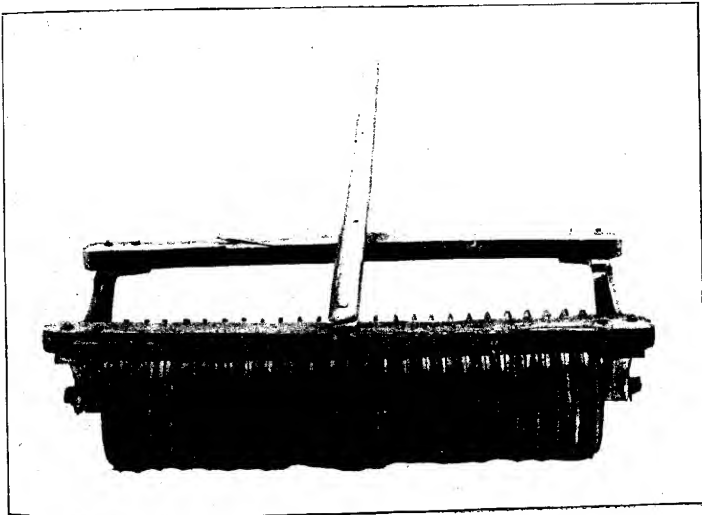


Fig. 2. Roller.

PLATE VI.

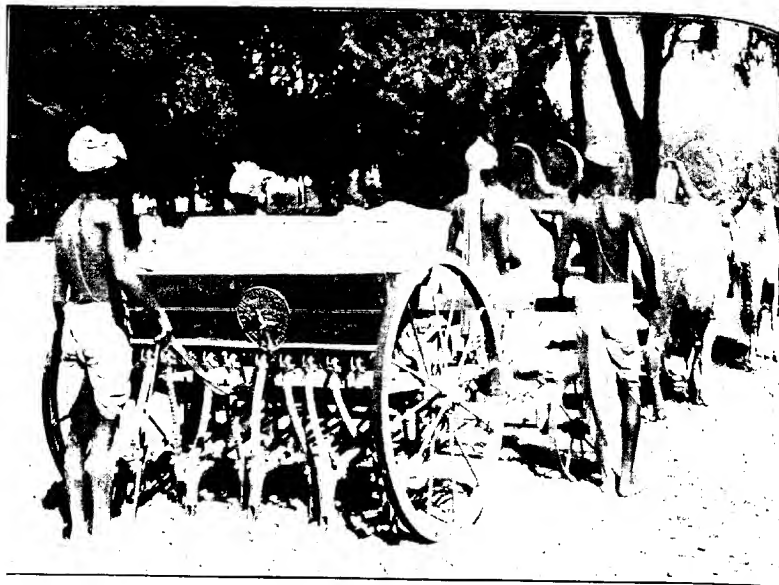


Fig. 1. Monarch Seed Drill.

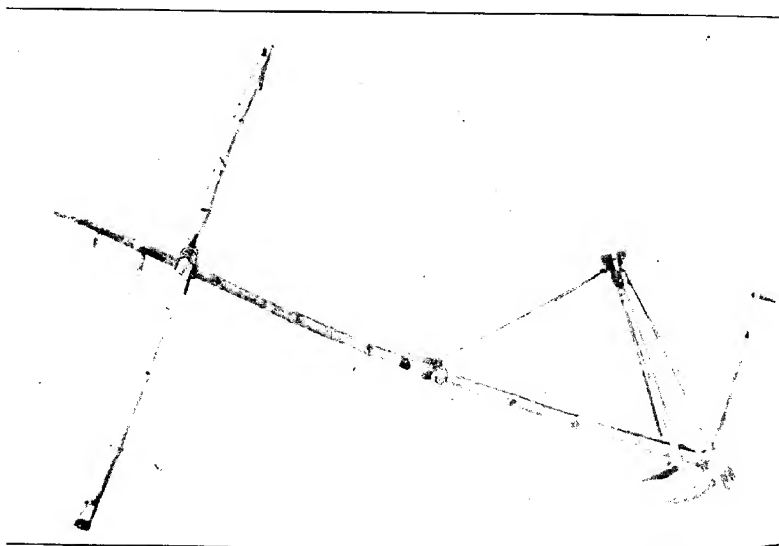


Fig. 2. Gujarat Seed Drill.

THE ROLLER.

(Plate V, fig. 2.)

The principal effects of the roller are to consolidate the soil and crush the clods. Great care should be exercised in using the roller. The land should not be left with a smooth surface as it will lose moisture. The surface should always be worked with lever harrows if the roller has been used after sowing. The great advantage of rolling in cases of land sown with wheat or oats, if used when crop is very young, is that it consolidates the soil around the roots of the plants and crops are less liable to lodge. It also kills grubs and crabs which have been found to do considerable damage to young seedlings. Smooth or flat and corrugated types of rollers are used. Rollers are generally made of wood or stone or cast iron. The Cambridge Roller, a corrugated one, (Plate V), is a good type. Its size depends on the actual requirements as the rings are detachable. Six feet long is common for a pair of bullocks. It will do about 6 to 8 acres in a day. Price, Rs. 200.

(c) Sowing Operations.

In India in most tracts seed is generally sown either broadcast or by dropping it behind a country plough and then covering with a *henga*. Where fields are suitable, however, it is much more economical to drill practically all crops. Not only is there considerable economy in seed, but interculture can be carried out by bullock power between rows, with a considerable saving of manual labour. At Pusa it is particularly important that the cold weather cereal crop should be sown in as good a seed bed as possible and as shallow as possible. The growing period is short and the moisture content is limited.

MONARCH SEED DRILL.

(Plate VI, fig. 1.)

The cereal drill used at Pusa is the "Monarch." It has a fore-carriage which can be seen in the Plate (No. VI) and this enables very much better work to be performed with unskilled labour. Two pairs of bullocks are required for sowing 9 drills. Ten to twelve acres can be sown in a day. It is manufactured by Messrs. Knapp of Clanfield, and the price is about Rs. 400 delivered in India. The seed rate for oats at Pusa is 64 lb. per acre. If broadcasted, 80 lb. per acre would be necessary,

GUJARAT DRILL.

(Plate VI, fig. 2.)

This is a country made implement and makes very good work with maize and cotton. The construction is seen in the plate. It is very simple and costs about Rs. 7. It is necessary to train both bullocks and man before any approach to a straight drill can be made. For hot weather crops the depth of seeds sowing is not so important. At Pusa practically all the maize is sown with this implement.

(d) Implements for Interculture.

Interculture work in the young crop between the rows is of the greatest importance. Not only is the moisture conserved and a mulch formed but the crop is kept in a healthy condition till the plants meet in the drill. The following is the list of intercultural implements :—

Wallace's Horse Hoe.

Planet Junior Indigo Cultivator.

Planet Junior Horse Hoe.

McCormic Deering One-horse Cultivator No. 55.

Lyallpur Hoe.

Opensi Parallel Expanding Horse Hoc.

Handy Andy.

Fowler Cultivator.

Hyder Cultivator.

"Desi" Gallion.

Out of the above list, the Wallace's Horse Hoe and the Planet Junior Indigo Cultivator, as shown in Plate VII, have been found thoroughly strong and efficient in actual practice. They are provided with 5-tines which have steel teeth like those of the spring tooth harrows. Both may also be used for general preparation of soil in place of the spring tooth harrow. By putting a ridging attachment to the hind tines, they can be used as ridgers.

THE WALLACE'S HORSE HOE.

(Plate VII, fig. 1.)

The Wallace's Horse Hoe is fitted with movable side tines to which mould board shovels can be fixed for throwing earth round the plants. It is provided with two handles and a hand lever for changing width

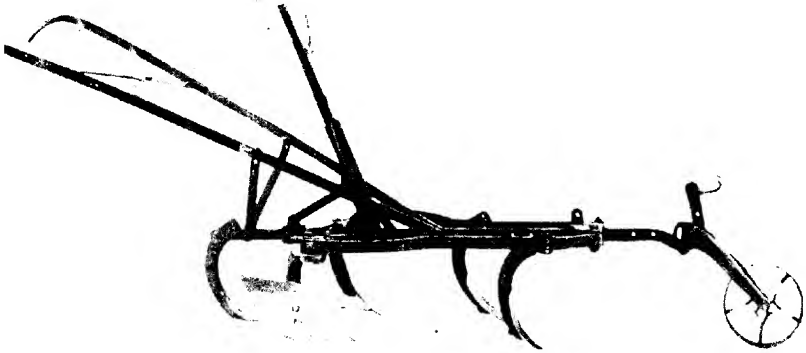


Fig. 1. Wallace's Horse Hoe.

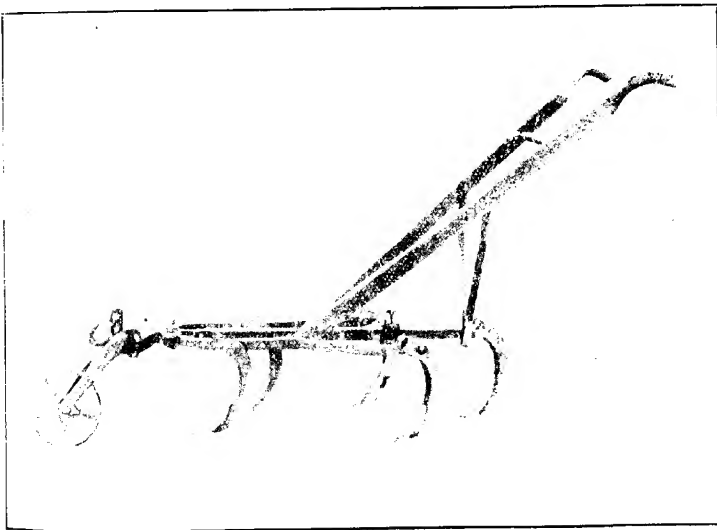


Fig. 2. Planet Junior Indigo Cultivator.

and also a fore-wheel. The whole implement is made of iron and remains rigid for years. One pair of bullocks can easily pull it. It will do 3 acres in a day. Price, Rs. 55; sold by Messrs. Volkart Bros., Lyallpur and Bombay.

THE PLANET JUNIOR INDIGO CULTIVATOR.

(Plate VII, fig. 2.)

The Planet Junior Indigo Cultivator is a light and simple implement fitted with 5-tines as in the case of Wallace's Hoc. Where earthing up is not required, this is a useful implement for ordinary interculture. It is light and handy for a small pair of bullocks, has no hand lever but a fore-wheel. The width may be adjusted by means of a set-screw. It can be fitted with one or two handles as required. Work per day, 3 acres; price, Rs. 33; sold by Messrs T. E. Thomson & Co., Calcutta.

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